Desalination and Water Treatment
www.deswater.com

doi: 10.1080/19443994.2014.965224

56 (2015) 3044–3053
December

Taylor & Francis
Taylor & Francis Group

Toxic effect of H_2O_2 in H_2O_2/UV, photo-Fenton and heterogeneous photocatalysis (TiO_2/H_2O_2/UV) systems to treat textile wastewater

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Received 1 April 2014; Accepted 7 September 2014

ABSTRACT

The application of H_2O_2/UV, photo-Fenton and heterogeneous photocatalysis (TiO_2/H_2O_2/UV) processes for the treatment of a highly polluted coloured wastewater was analysed. The experiments were carried out with different H_2O_2 concentrations (0.25, 0.5, 1, 2 and 5 g/L). The toxic properties of different H_2O_2 concentrations in textile wastewater were tested by the use of a Microtox bioassay with *Vibrio fischeri*. The efficiency of the process was checked by assessing the physicochemical parameters, total organic carbon (TOC) and colour. The use of TiO_2 as a catalyst with UV photolysis was the most effective method to remove toxins, organic material and colour using the five concentrations of H_2O_2 tested. By using 5 g/L of H_2O_2, 94% TOC removal was achieved. In relation to colour removal, this was greater than 99% with 5 g/L of H_2O_2 in all three processes. The use of a catalyst allowed us to reduce the hydraulic retention time of the process to 30 min with Fe^{2+} and 45 min with TiO_2. Controlling the amount of H_2O_2 used as the oxidant in an advanced oxidation process (AOP) is important since it was found to increase the toxicity of the influent with the addition of H_2O_2 by $4.99 \pm 1.48\%$, $27.4 \pm 3.24\%$, $39.16 \pm 5.64\%$, $53.40 \pm 4.15\%$ and $59.39 \pm 4.67\%$ with 0.25, 0.5, 1, 2 and 5 g/L H_2O_2, respectively. Therefore, under the studied conditions, an H_2O_2 concentration greater than 1 g/L is not recommended for an AOP in order to avoid an excess of H_2O_2 in the effluent.

Keywords: AOP; Catalyst; Toxicity; Colouring

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